CLAIMS

1. A method for classifying elements of a digital image, the method comprising:

receiving an element of the digital image and a prototype representing a class of elements;

generating a difference image representing differences between the received element and the prototype and including a plurality of ON pixels, each ON pixel representing a local difference between the received element and the prototype, wherein the difference image includes one or more clusters of ON pixels, each cluster including one or more neighboring ON pixels;

determining relative arrangements of ON pixels in the difference image;

assigning one or more scores to the difference image using the determined relative arrangements of ON pixels in the difference image; and

based on the scores assigned to the difference image, determining whether the received element of the image belongs to the class represented by the prototype.

2. The method of claim 1, further comprising:

identifying one or more of the clusters of ON pixels in the difference image.

3. The method of claim 2, wherein:

determining relative arrangements of ON pixels in the difference image includes, for each identified cluster, determining a relative arrangement of ON pixels in the cluster, the determined relative arrangement specifying a shape for the cluster.

4. The method of claim 3, wherein:

assigning one or more scores to the difference image includes assigning a score to each cluster based on the shape of the cluster.

5. The method of claim 1, wherein:

assigning one or more scores to the difference image includes assigning a score to each ON pixel in the difference image.

6. The method of claim 5, wherein:

assigning a score to each ON pixel includes assigning a score to each ON pixel based on a number of other ON pixels in a predetermined neighborhood of the ON pixel.

7. The method of claim 6, wherein:

assigning a score to each ON pixel includes assigning a score to each ON pixel according to a monotonously increasing function of the number of other ON pixels in the predetermined neighborhood of the ON pixel.

8. The method of claim 7, wherein:

the monotonously increasing function includes an exponential function of the number of ON pixels in the predetermined neighborhood.

9. The method of claim 8, wherein:

the exponential function is two to the power of the number of ON pixels in the predetermined neighborhood.

10. The method of claim 1, wherein:

generating a difference image includes generating a difference image that includes one or more OFF pixels, each OFF pixel representing lack of local difference between the received element and the prototype.

11. The method of claim 1, wherein:

receiving an element of the digital image includes receiving a bitmap image element including neighboring pixels of the same bit value.

12. The method of claim 11, wherein:

receiving a prototype includes receiving a bitmap of the prototype.

13. The method of claim 12, wherein:

generating a difference image includes performing a Boolean exclusive-or operation of each pixel of the bitmap image element with the bitmap of the prototype.

14. The method of claim 1, further comprising:

generating a representation of the digital image, the generated representation including a symbol map associating one or more elements of the digital image with the prototype of the class.

15. The method of claim 14, wherein:

if it is determined that the received element belongs to the class of the prototype, generating a representation of the digital image includes using the symbol map to represent the received element with the prototype of the class.

16. The method of claim 1, wherein:

receiving a prototype representing a class of elements includes receiving a glyph representing a character; and

determining whether the received element belongs to the class represented by the prototype includes determining whether the received element represents the character.

17. The method of claim 16, further comprising:

if it is determined that the received element represents the character, generating a text representation using a character code of the character.

18. The method of claim 17, wherein:

generating a text representation includes using a font that maps the character code to the glyph representing the character.

19. A software product, tangibly embodied in a machine-readable medium, for classifying elements of a digital image, the software product comprising instructions operable to cause one or more data processing apparatus to perform operations comprising:

receiving an element of the digital image and a prototype representing a class of elements;

generating a difference image representing differences between the received

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element and the prototype and including a plurality of ON pixels, each ON pixel representing a local difference between the received element and the prototype, wherein the difference image includes one or more clusters of ON pixels, each cluster including one or more neighboring ON pixels;

determining relative arrangements of ON pixels in the difference image;

assigning one or more scores to the difference image using the determined relative arrangements of ON pixels in the difference image; and

based on the scores assigned to the difference image, determining whether the received element of the image belongs to the class represented by the prototype.

20. The software product of claim 19, further comprising instructions operable to cause one or more data processing apparatus to perform operations comprising:

identifying one or more of the clusters of ON pixels in the difference image.

21. The software product of claim 20, wherein:

determining relative arrangements of ON pixels in the difference image includes, for each identified cluster, determining a relative arrangement of ON pixels in the cluster, the determined relative arrangement specifying a shape for the cluster.

22. The software product of claim 21, wherein:

assigning one or more scores to the difference image includes assigning a score to each cluster based on the shape of the cluster.

23. The software product of claim 19, wherein:

assigning one or more scores to the difference image includes assigning a score to each ON pixel in the difference image.

24. The software product of claim 23, wherein:

assigning a score to each ON pixel includes assigning a score to each ON pixel based on a number of other ON pixels in a predetermined neighborhood of the ON pixel.

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25. The software product of claim 24, wherein:

assigning a score to each ON pixel includes assigning a score to each ON pixel according to a monotonously increasing function of the number of other ON pixels in the predetermined neighborhood of the ON pixel.

26. The software product of claim 25, wherein:

the monotonously increasing function includes an exponential function of the number of ON pixels in the predetermined neighborhood.

27. The software product of claim 26, wherein:

the exponential function is two to the power of the number of ON pixels in the predetermined neighborhood.

28. The software product of claim 19, wherein:

generating a difference image includes generating a difference image that includes one or more OFF pixels, each OFF pixel representing lack of local difference between the received element and the prototype.

29. The software product of claim 19, wherein:

receiving an element of the digital image includes receiving a bitmap image element including neighboring pixels of the same bit value.

30. The software product of claim 29, wherein:

receiving a prototype includes receiving a bitmap of the prototype.

31. The software product of claim 30, wherein:

generating a difference image includes performing a Boolean exclusive-or operation of each pixel of the bitmap image element with the bitmap of the prototype.

32. The software product of claim 19, further comprising instructions operable to cause one or more data processing apparatus to perform operations comprising:

generating a representation of the digital image, the generated representation

including a symbol map associating one or more elements of the digital image with the prototype of the class.

33. The software product of claim 32, wherein:

if it is determined that the received element belongs to the class of the prototype, generating a representation of the digital image includes using the symbol map to represent the received element with the prototype of the class.

34. The software product of claim 19, wherein:

receiving a prototype representing a class of elements includes receiving a glyph representing a character; and

determining whether the received element belongs to the class represented by the prototype includes determining whether the received element represents the character.

35. The software product of claim 34, further comprising instructions operable to cause one or more data processing apparatus to perform operations comprising:

if it is determined that the received element represents the character, generating a text representation using a character code of the character.

36. The software product of claim 35, wherein:

generating a text representation includes using a font that maps the character code to the glyph representing the character.